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mass simply, but to the duration of the commodity, to the time elapsing while it is being consumed.

The theory of varying degrees of utility seems to have its origin in the fact, that, assuming the provident trait to be perfectly developed, the intensity of our desires of a prospective nature varies with our estimate of probable utility, the probability decreasing as the length of time estimated to ensue before the anticipated satisfaction increases; Jevons's chapter on the 'Theory of utility,' with the necessary changes in phraseology, would furnish an excellent discussion on the subject of desires of a prospective nature, which do have two dimensions,—one the estimated intensity of the anticipated satisfaction, the other its probability as affected by the length of time to elapse before its estimated occurrence.

But when we enter upon discussion as to the sources of desires, and how desires may be modified, we must say, with Pascal, "C'est un cercle infini, dont le centre est partout la circonference nulle part."

A. E. ROGERS.

Orono, Me., Oct. 5.

Earthquake sounds.

Does any one attempt to offer an explanation for the sound that preceded and accompanied the late earthquake, or earthquakes in general, where the sounds are noticeable? I supposed it was presumable that they were due to the commotion in the earth's crust caused by the radiating waves. But how can that be, when the earth-waves move six to eight times faster than sound-waves? If that be so, would it not appear as if the sound-waves ought in part to come up after the shock has passed? I was asleep when the first and heaviest shock first reached this place (six miles west of Greensborough, in Guilford county), so I cannot tell to what extent the sound preceded the shock. There were two subsequent shocks which were preceded by low roaring and rumbling, so that we predicted the coming of the earth-waves. I said to my wife, 'Now we will have another shake;' and we waited probably three seconds after I had spoken, when the house began to rock. I do not expect you to write me personally, as you will not likely have time, but, if my question should be worthy of note, perhaps some of the geologists of your company could give us a line through *Science*. JOSEPH MOORE.

New Garden, N.C., Oct. 6.

Unexplained noises.

Your comment on mysterious noises in *Science* for Oct. 1 recalls to my memory a very remarkable instance of the transmission of sound and motion.

On the 14th of February, 1862, I was working with my father in his sugar orchard ten miles west of Madison, Ind., and five miles north of the Ohio River. During the entire morning, which was warm, cloudy, and calm, we heard most distinctly the discharges of heavy artillery. The reports would often follow in quick succession. I, as most lads would have been in similar circumstances, became thoroughly alarmed. I felt quite sure that the whole confederate army was close upon us, since the source of the cannonading seemed to be no farther south than the river.

I finally prevailed upon my father to go home, where we found the inmates of the house greatly alarmed at the noises and the rattling of the windows. The shocks, as I remember them, were much like the slight earthquake disturbances experienced lately in

different parts of the country. For several miles along the river these noises were heard and the shocks felt. Nevertheless the day passed, and no invading foe appeared. The morrow brought the news of the bombardment of Fort Donelson.

When it is remembered that Fort Donelson is more than two hundred miles from the locality just described, it is certain that these concussions could not have been carried through the air.

I have been told that the limestone formation coming to the surface along the right bank of the river in Jefferson county, Ind., is the same as that on which Fort Donelson rests. The cannonading which was heard so distinctly that day by hundreds of people in Indiana occurred at Fort Donelson, and the sound-waves were conveyed entirely across Kentucky, and probably at a considerable depth below the surface, by a continuous ledge of limestone. I have thought the phenomena above described worthy of record in your columns.

H. W. WILEY.

Fort Scott, Kan., Oct. 8.

How astronomers may work.

In your editorial of Sept. 24, referring to Professor Pickering's plan for making the Harvard college observatory useful to all other observatories, and to astronomers all over the world, you also notice a plan of my own, which I formulate as follows:—

"We mean to put the large telescope (of the Lick observatory) at the disposition of the world by inviting its most distinguished astronomers to visit us one at a time, and by giving to them the use of the instrument during certain specific hours of the twenty-four. In this way we hope to make the gift of Mr. Lick one which is truly a gift to science, and not merely one to California and to its university."

Your comment on this plan is that you suspect that Professor Holden 'was hard-pressed to devise it.'

I trust that your impression will not be shared by Professor Young, if he remembers the discomforts of his expedition to Sherman; or by Professor Langley, if he recalls the hardships of his own to Mount Whitney; or by Dr. Huggins, when he recollects the hundreds of failures which have come in his delicate researches in spectroscopy and photography from the London climate; or by Mr. Burnham, when he remembers how many of the double stars which he discovered at Mount Hamilton with a six-inch telescope were 'difficult' in Chicago with one of eighteen inches. Not to mention any other names, I am sure that these astronomers will feel a sense of gratitude when the facilities of the Lick observatory and the opportunities of its climate are put at their disposition, and will attribute the offer to a generous desire to forward science, and not to a scheme to eke out a scanty income. As a matter of fact, I have directed the policy of the observatory since 1874, and it is a pleasure to me to be able in 1886 to announce a plan which has been constantly in my thoughts for more than ten years, and which seems to me to be a long step in the true direction. I trust it will also seem to be such to my fellow-astronomers. It would have been natural to have looked for the same view from the editor of *Science*; but, as long as the plan commands their respect and my own, it will be carried out. You will have to look to its results to see if it may not eventually command your own also.

EDWARD S. HOLDEN.

Berkeley, Cal., Oct. 2.